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handwriting had begun to show the advancing years; but his pen had not lost its cunning nor had his sarcasm begun to fail. It is, like others of his earlier years, a plea for human rights,—this time for two men in prison in Geneva.

> "I do not know the rubrics of the city of Calvin—and I do not wish to know them! Twenty citizens have come to see me, as once the fishwives of Paris paid me a similar honor. I prepared for the latter a little compliment for the King, which was well received; and I did the same for these citizens, but this has not been received in similar fashion. It appears that certain gentlemen of twenty-five are greater seigneurs than the King. I did not know that fishwives had greater privileges than such citizens; but I ask your protection for these poor devils who know only that they exist. I do not speak of the 'perruques quarrées' but of these native citizens."

This is not mathematical; it is not the letter of a mathematician; but it gives a personal view of a man who did something for mathematics and everything that man could do in the middle of the eighteenth century for human liberty.

QUESTIONS AND DISCUSSIONS.

EDITED BY W. A. HURWITZ, Cornell University, Ithaca, N. Y.

NEW QUESTION.

The discussion below by Professor Bradley leads to the request for consideration by readers of the MONTHLY of the following question:

45. Is every non-trivial solution in integers of the equation $t^3 = x^3 + y^3 + 1$ expressible in the form $x = 9r^4 - 3r$, $y = 9r^3 - 1$, $t = 9r^4$? If there are non-trivial solutions not expressible in this form, can a general solution be found?

REPLIES.

30. (*1916*, 88, 354; *1920*, 114, 362; *1921*, 124). A certain Normal University wishes to offer thirty-five hours of college mathematics for the benefit of high school teachers. What should these courses be in order that, primarily, they may be of the greatest value to high school teachers of mathematics and, secondarily, that they may furnish stimulus for a more extended pursuit of the subject?

REPLY BY T. G. RODGERS, New Mexico Normal University.

It is disappointing that the above question has not called forth a full and varied discussion from which, at least, a certain minimum of essential courses might be agreed upon. Such a discussion would be of great value to a certain class of institutions and the secondary schools with which they are closely associated.

Readers of the MONTHLY may have considered that the replies to Question 31 (*1916*, 395–399), included the above. These excellent articles gave existing conditions in standard colleges and universities but had no reference to normal schools.

Until comparatively recent years no professional training of college rank for the benefit of secondary teachers of mathematics existed in this country and the normal schools confined their efforts to the training of teachers for the grades. At present, as the above replies point out, many colleges, especially the universities with large graduate departments, offer some courses designed primarily for teachers of secondary mathematics. The normal schools which are collegiate institutions, but not graduate institutions, are gradually teaching other college subjects besides their traditional two years of professional training for teachers of the grades.

The colleges and universities, however, though offering courses in the teaching of subjects, put the emphasis upon the development of an atmosphere conducive to the pursuit of scholarship and research rather than good teaching, while the normals lay the emphasis upon the development of enthusiasm for good teaching rather than for research. The universities supply the teachers for the large high schools which can afford to pay for graduate training; the normals supply the best grade teachers. This leaves the small high schools, many offering less than a four years' course, which abound in the nation, without provision. This class of schools has been forced to recruit its teachers too largely from the grade, teachers who have had no direct training in the subject they are called to teach other than that gained in the secondary school.

With conditions as they are, the normal schools, by extending the scope of the work which they are doing, can best serve this class of high schools and also the rapidly developing junior high schools. For these schools thorough training in the best methods of teaching a subject with a fair amount of scholarship is of much greater value than more extended scholarship and indifferent methods of teaching.

Normal schools cannot offer more than thirty-five or forty semester hours of work in any particular subject and remain distinct institutions with a definite task to perform. Otherwise they lose their first love and become mere duplications of colleges. What should these courses be in mathematics? Who can say? For the purpose of provoking a valuable discussion, the writer ventures to suggest the following:

Plane trigonometry, three hours; algebra, three; analytic geometry, five; differential and integral calculus, six; modern geometry, five; the pedagogy of arithmetic, two; the pedagogy of algebra, two; the pedagogy of plane geometry, two; the pedagogy of solid geometry, two; observation in the practice high school, two; the remaining three hours to be given to a further study of analytic geometry, calculus or modern geometry, as the particular class elects. For the ends sought these introductory courses are better than longer courses in fewer subjects.

The work in trigonometry should emphasize the use of tables, the slide rule, the solution of triangles and a fair amount of theoretical work including inverse functions. The algebra should put the emphasis upon theory and logic rather than technique, and center around the simple progressions, quadratics, combinatory analysis, the theory of equations and the determinant. In analytics the straight line, the circle, functions and graphs, and the transformation of coordinates should receive the emphasis. For the purpose in view a six hour course based on some recent text in calculus of the type of that of March and Wolff will yield richer results than the more formal work in differential and integral calculus of the older type.

A high school teacher who can give but five hours to modern geometry will gain more that is of direct value to him if he divides it into a two hour course in simple theorems pertaining to concurrent lines, collinear points, the homothetic transformation, the transformation by inversion, the radical axis, coaxal circles and possibly polar reciprocal figures and applies them to construction work. This should be followed by a three hour course in synthetic projective geometry.

In each of the pedagogical courses a portion of the time should be given to a serious study of the history and literature of the subject of the course. There is an immense amount of material for this phase of the work. It must be gained from elementary histories of mathematics; books on the teaching of mathematics of such authors as Smith, Young and Stone; government bulletins on the teaching of mathematics, including the reports of the National Committee on Mathematical Requirements and the International Commission on the Teaching of Mathematics; and text books of different types, including some of foreign countries.

In addition to this purely pedagogical phase the prospective teacher needs the special study of the most difficult parts of each subject. In algebra he should take a dip into analysis, studying such topics as the number system, irrational numbers, limits, infinite series and topics that the individual class seems to need. In plane geometry he should get a survey of the foundations of geometry, become acquainted with the famous problems of antiquity and as far as time permits study the subject from the larger view of such works as Hadamard, *Leçons de Géométrie.* In solid geometry this larger view point so essential to a teacher can be gained by the study of selected portions of such works as Hadamard, *Leçons de Géométrie dans l'Espace.*

It is highly desirable that secondary teachers of mathematics become acquainted with the scholarly ideals of some of the best foreign works on elementary algebra and geometry. But for such a brief course the professor will have to make the selections and give them in lecture form to be worked up by the students.

With this as a foundation the students are in fine condition to observe in the practice high school, and meet one hour a week for conference and discussion of what they have observed. For a semester's work of this kind two hours of college credit seem sufficient.

Since this work is taken in a normal school it is understood that these students have also had the regular training in psychology and education.

It is admitted that this is a brief course in mathematics for a secondary teacher of mathematics. But until the standards of preparation for this class of teachers can be raised throughout the nation, the writer believes this represents a step in the right direction for the preparation of teachers for the junior high school and the small high school.

DISCUSSIONS.

The two short discussions seem to require no comment. We should be glad if Question 45, printed above, which is called forth by Professor Bradley's discussion of the Diophantine equation $t^3 = x^3 + y^3 + 1$, should receive some interesting replies. Mr. Roman's note on a humble phase of the mathematics of investment should be entertaining.

I. On a Diophantine Equation.[1]

By H. C. Bradley, Massachusetts Institute of Technology.

On page 77 of the February number of the Monthly, Professor R. D. Carmichael asks, among other things, for a general solution of the Diophantine equation $t^3 = x^3 + y^3 + 1$.

I wrote to Professor Carmichael, calling attention to the following. In his own *Diophantine Analysis*, p. 65, he gives a general solution of $x^3 + y^3 = u^3 + v^3$ as follows:

$$x = -(a - 3b)(a^2 + 3b^2) + 1, \qquad y = (a + 3b)(a^2 + 3b^2) - 1,$$
$$u = -(a^2 + 3b^2)^2 + (a + 3b), \qquad v = (a^2 + 3b^2)^2 - (a - 3b).$$

Now let $a = 3b$, then let $2b = r$, and change the variables, and we have

$$x = 9r^4 - 3r, \qquad y = 9r^3 - 1, \qquad t = 9r^4;$$

which is a solution of $t^3 = x^3 + y^3 + 1$.

Or, if we assume the possibility of a solution of the form $x = Ar^4 - Br$, $y = Cr^3 - 1$, $t = Ar^4 + Dr$, the coefficients may be determined as above.

This solution gives $9^3 = 6^3 + 8^3 + 1$, $144^3 = 138^3 + 71^3 + 1$, $729^3 = 720^3 + 242^3 + 1$, etc. It fails to include the trivial case $x = y = 0$, $t = 1$.

Professor Carmichael replied that this was interesting, but asked if I could prove that it gave all non-trivial integral solutions of the given equation. This I cannot do. So at his suggestion I am sending the result, thinking that perhaps some other readers of the Monthly might be interested to work on it.

II. A Note on War Savings Stamps.

By Irwin Roman, Northwestern University.

The accompanying table illustrates an interesting property of the War Savings Stamps issued by the government in 1918. A similar table holds for later issues. The third column gives the amount which the post-office will pay for each five dollar stamp during the month. If we consider this amount as reinvested, the fourth column gives the profit accrued at maturity, while the fifth column gives the per cent. this profit is of the amount thus reinvested. The final column shows the annual rate of interest corresponding to the case.

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[1] Extract from a letter to the Editor.